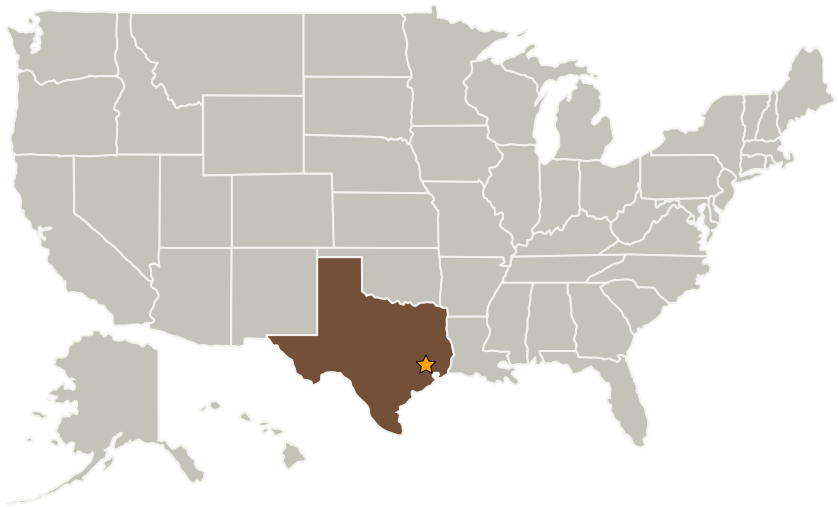
Hierarchial composites comprising continuous carbon nanotube composite fibers in a nanotube-reinforced matrix, Phase II

Completed Technology Project (2003 - 2005)

Project Introduction

NASA requires dramatic advancements in material properties to improve launch vehicles, spacecraft, and the space station?s performance. Our plan is to provide: 1) Continuous carbon nanotube (CNT) composite fibers stronger than 10 GPa and tougher than any known material. 2) CNT fiber composites stronger than 6 GPa. We propose to develop hierarchical composites comprising continuous CNT composite fibers in CNT-reinforced matrices (CPMs). We plan to: (1) Produce continuous CNT fibers with tensile strength >10 GPa and toughness >1000 J/g; (2) Develop CPMs optimized for application with CNT composite fibers; (3) Integrate continuous CNT fibers with CPMs to produce CNT fiber/CPM composites with tensile strength of > 6 GPa, twice the specific strength of carbon fiber/epoxy composites, and a toughness higher than any known material. This program builds on two recent breakthroughs. Zyvex?s CNT solubilization technique dramatically increases organic solubility of CNTs without degrading their properties. A 5% loading of CNTs triples the tensile strength of cast epoxy. The UTD group produced continuous CNT composite fibers having quadruple the specific strength and double the modulus of the best steel wire and 20 times the toughness. These fibers provide a toughness of 600 J/g, much higher than any previously known material.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
ZYVEX Corporation	Supporting Organization	Industry	Richardson, Texas

Primary U.S. Work Locations
Texas

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Erica Sullivan

Principal Investigator:
Jian Chen

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials